| **Grade** | **Big Idea** | **Essential Questions** | **Concepts** | **Competencies** | **Vocabulary** | **Standard** | **Eligible Content** |
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| **PK-2** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Observable changes and patterns in the sky are caused by motions in the Earth-Moon-Sun system. | Identify stars, Moon, and Sun in the day and night sky.  Use observations to describe patterns of objects in the sky that are cyclic and can be predicted. | Moon  Star  Sun  Observe  Pattern  Describe  Predict  Changes  System | 3.3.4.B1  3.3.4.B2 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3  S4.D.3.1.1  S4.D.3.1.2 |
| **PK-2** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Patterns of the motion of the sun, moon and stars in the sky can be observed, described and predicted.  Most stars that we see are in our own Milky Way Galaxy. | Observe, describe, and predict patterns of daily change in the appearance and visibility of the moon.  Observe, describe, and predict patterns of seasonal change in the timing and position of sunrise and sunset. | Moon  Sunrise  Sunset  Predict  Sky  Milky Way Galaxy | 3.3.4.B2 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3  S4.D.3.1.1  S4.D.3.1.2  S4.D.3.1.3 |
| **PK-2** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | At night one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the moon, planets and galaxies in greater detail. Most stars that we see are in our own Milky Way Galaxy. | Use binoculars or telescopes to enhance observations (e.g. seeing the moons of Jupiter through binoculars). | Binocular  Telescope  Planet  Galaxy  Star | 3.3.4.B1  3.3.4.B2 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3  S4.D.3.1.1  S4.D.3.1.2 |
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| **3-4** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | N/A | N/A | N/A | N/A | N/A |
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| **5-6** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | The phases of the Moon are caused by the orbit of the moon around the Earth. | Identify, measure, and explain monthly patterns in the phases of the Moon.  Use a model of the relative positions of the sun, earth and moon to explain the phases of the moon. | Measure  Pattern  Phase | 3.3.4.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **5-6** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Changes in seasons are due to the inclination of Earth's axis of rotation combined with Earth's orbit around the Sun. | Identify and explain the position and orientation of the Earth as it orbits the Sun.  Identify and explain cyclical patterns of seasonal changes in terms of length of day and sunrise/sunset. | Position  Orbit  Cyclical Pattern  Season  Axis  Rotation | 3.3.4.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **5-6** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Observable patterns and changes in tides are caused by the Earth-Moon-Sun system. | Use models of the Earth-Sun-Moon system to support explanations and predict the cyclic patterns of tides. | Tide  System |  | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **5-6** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Observable eclipses are caused by motions in the Earth-Moon-Sun system. | Use models of the Earth-Sun-Moon system to support explanations and predict the cyclic patterns of eclipses. | Eclipse |  | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **5-6** | The universe is composed of a variety of different objects which are organized into systems each of which develops according to accepted physical processes and laws. | What are the predictable patterns caused by different objects in the solar system?  How do objects in the universe appear and behave? | Earth’s spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of the Earth’s tilt on its axis and are caused by the differential intensity of sunlight on different areas of Earth across the year. | Use models of Earth's orientation and motion to explain how seasonal changes in intensity and duration of daily sunlight lead to seasons | Earth Orientation  Tilt  Axis | 3.3.6.B2 3.3.7.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
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| **7-8** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | The universe began with a period of extreme and rapid expansion known as the Big Bang. | Communicate technical information about how technology has led to discoveries of the expansion scale of the universe and about the scientific theories that explain these observations. | Big Bang  Scientific Theory  Universe | 3.3.6.B1 3.3.5.B1 3.3.7.B1 3.3.7.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **7-8** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | Earth and its solar system are part of the Milky Way Galaxy, which is one of many galaxies in the universe. | Construct and use scale models to describe the relationship of Earth to the rest of the solar system, the Milky Way Galaxy, and the universe | Model  Galaxy  Universe | 3.3.6.B1 3.3.5.B1 3.3.7.B1 3.3.7.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
| **7-8** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | Our solar system is a collection of objects, including planets, their moons, and asteroids that are in orbit around the Sun. | Construct and use scale models of the solar system to support the explanation of the motions of the planets of the observed system. | Model  Solar System  Asteroids | 3.3.5.B1 3.3.6.B1 3.3.7.A4 3.3.7.B1 3.3.6.B2 3.3.7.B2 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2  S8.D.3.1.1  S8.D.3.1.2  S8.D3.1.3 |
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| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | The Sun is just more than two hundred billion stars in the Milky Way Galaxy, and the Milky Way is just one of hundreds of billions of galaxies in the universe. | Use models to describe the sun’s place in space in relation to the Milky Way Galaxy and the distribution of galaxy clusters in the universe.  Use data about the expansion, scale, and age of the universe to explain the Big Bang theory as a model for the origin of the Universe | Model  Galaxy  Clusters  Big Bang | 3.3.10.B1 |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | The Big Bang Theory is supported by observations of distant galaxies receding from one another, of the measured composition of stars and non solar gases, and the maps of the spectra of the primordial radiation that still fills the universe. | Construct explanations based on observable astronomical data as empirical evidence for the Big Bang Theory and the role that technologies have played in obtaining this data. | Astronomical  Data  Big Bang  Non solar Gases  Spectra  Primordial Radiation |  |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | The solar system appears to have formed from a disc of dust and gas, drawn together by gravity. | Construct explanations from data for the formation of the solar system based on space exploration and astronomical evidence of the compositional structure and motion of solar system bodies. | Astronomical Evidence |  |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | Different stars change in different ways throughout their life cycle. | Explain the life cycle of our sun as well as less massive and more massive stars |  |  |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | Nuclear fusion within stars produces atomic nuclei lighter than an including iron. Heaver elements are produced and distributed through supernovae | Synthesize and communicate technical information about the processes by which stars produce new elements over their changing life times. | Nuclear fusion  Nuclei  Supernova |  |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | The study of stars’ light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. | Use data to describe the composition of stars and their distance from Earth.  Use models to describe the origin of elements created in stellar interiors and released through supernovae. | Stellar  Supernova | 3.3.10.B2, 3.3.12.B1 |  |
| **9-12** | The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. | How do objects in the universe appear and behave? | Kepler’s laws describe common features of the motions of orbiting objects, including their elliptical paths around the Sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. | Use mathematical and computational representations of natural and human made solar system objects in order to describe their motions and predict their trajectories and/or collisions. | Trajectory  Kepler’s Law  Elliptical | 3.3.10.B1, 3.3.12.A1 |  |
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| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Earth has changed over time with some changes being rapid and others being slow. | Identify and describe natural ways in which the earth’s surface could change over time. |  | 3.3.3.A1 3.3.4.A1 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Wind and water change the shape of the landscape. | Investigate how wind and water can move earth materials from one place to another and change the shape of landforms. | Earth materials  Landform | 3.3.3.A1 3.3.4.A1 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Maps display different land and water features and help show patterns in the distribution of rocks and other geological and geographical features. | Describe kinds and shapes of patterns of landforms and bodies of water.  Use geologic and geographic maps to identify features of the Earth in the community, in Pennsylvania, and globally. | Geologic  Geographic Map  Pennsylvania  Geological  Features  Land  Water | 3.3.4.A6 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The distribution and types of earth materials at or near Earth’s surface results from interaction of rocks and soils, water, air, and living organisms. These interactions both break down and form earth materials. | Identify and use geologic evidence from their community and relate it to local geography and geology | Rock  Soil  Geography  Geology | 3.3.4.A2 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Weather is the combination of sunlight, wind, snow or rain and temperature in a particular region at a particular time.  People measure these features to describe and record the weather and to notice patterns over time | Observe, record and share local weather conditions to describe changes over time and identify patterns.  Obtain information from text and other media about different types of local weather including severe weather. | Weather  Conditions  Region |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | A variety of hazards result from natural processes (e.g. severe weather, floods, and coastal erosion). Humans cannot eliminate natural hazards but can take steps to reduce their impacts. | Obtain and evaluate information about a variety of weather-related hazards and their causes. Use that information to design or evaluate solutions to reduce hazards. | Hazard  Natural Process  Natural Hazard  Design  Evaluate  Solution | 3.3.A5 3.3.4.A5 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Water is found in the ocean, rivers, lakes, ponds, and as groundwater beneath the surface. Water exists as solid ice, in liquid form, and as a vapor. | Investigate and represent the various forms of water in their local environment, on Earth, and also on other planets and moons.  Use observations to construct explanations that water exists in different forms in natural landscapes. | Earth  Moon  Planet  Lake  Pond  River  Ocean  Groundwater  Liquid  Landscape | 3.3.4.A5  3.3.3.A5 3.3.3.A4 3.3.4.A4 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
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| **3-4** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. | Use scientific data from a variety of sources to identify geographic patterns in geologic phenomena and identify potential hazards. | Mountain  Range  Trench  Earthquake  Volcano  Geographic  Geologic | 3.3.4.A1 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **3-4** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Weather is the minute-by-minute to day-by-day variation of the atmosphere’s condition on a local scale.  Scientists record patterns of the weather across different times and areas of the weather so that they can make predictions about what kind of weather might happen next. | Organize simple weather data sets to record local weather data and identify day to day variations, as well as, long term patterns of weather.  Use mathematical and computational thinking to record and analyze local weather data to identify day-to-day variations and long-term patterns. | Weather  Data  Atmosphere | 3.3.A5 3.3.4.A5 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **3-4** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over a period of many years. | Obtain and communicate information about the similarities and differences between weather and climate.    Display simple data sets in tables and graphs to display typical weather conditions expected during a particular season and identify variations over years. | Weather  Climate | 3.3.3.A5 3.3.4.A5 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **3-4** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Many types of rocks and minerals are formed from the remains of organisms or are altered by their activities. | Use fossils as evidence to infer that some rocks were formed from the remains of once living organisms.  Identify evidence from patterns in rock formations and fossils in rock layers to support the explanation for a change in landforms and environments over time. | Fossil  Organism  Landform | 3.3.4.A3 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
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| **5-6** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. The energy is derived from the sun and the earth’s interior. These flows and cycles produce chemical and physical changes in Earth’s materials and living organisms. | Construct and analyze models to describe systems interactions among the geosphere, hydrosphere, atmosphere, and biosphere.  Plan and carry out investigations that model the chemical and physical processes that cycle earth materials and form rocks. | Model  Geosphere  Hydrosphere  Atmosphere  Biosphere  Chemical Change  Physical Change  Energy Flow | 3.3.4.A4 3.3.4.A5 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **5-6** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land. | Investigate movement of water in the Earth's systems and research and develop models for the cycling of water.  Investigate water systems to identify seasonal and annual variations in precipitation and stream flow and the causes of those variations. | Water Cycle  Water System  Precipitation  Transpiration  Atmosphere | 3.3.5.A4 3.3.6.A4 3.3.8.A4 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **5-6** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.  These interactions vary with latitude, altitude and local and regional geography. | Collect data and generate evidence to show how changes in weather conditions result from the motions and interactions of air masses.  Construct and use models to support the explanation of how the unequal heating of earth’s surface and earth’s rotation result in patterns of atmospheric and oceanic circulation that vary with latitude, altitude and local and geographical land distribution. | Oceanic Circulation  Altitude  Latitude  Geography  Weather  Climate | 3.3.7.A6 3.3.6.A6 3.3.6.A5 3.3.8.A4 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **5-6** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The ocean and other large bodies of water exert a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents | Construct explanations from models of oceanic and atmospheric circulation, and for the development of local and regional climates. | Oceanic Circulation  Atmospheric Circulation |  | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
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| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Major events in Earth's history leave evidence in the geologic record that allows the construction of a geologic time scale based on relative ages. | Use patterns in geologic evidence to determine the relative ages and sequence of geologic events in Pennsylvania and on the rest of the Earth.  Apply scientific reasoning using geological evidence to determine the relative ages of a sequence of events that have occurred in Earth’s past. | Geologic Evidence  Geologic Time Scale | 3.3.7.A3 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth’s surface and provides a framework for understanding its geological history. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. | Develop and use models of past plate motions to support explanations of existing patterns in the fossil record, rock record, continental shapes and sea floor structures..  Incorporate a variety of data including geological evidence from maps and representations of current plate motions to predict future plate motions.  Use models to explain how the flow of energy drives the cycling of matter between Earth's surface and deep interior. | Model  Fossil Record  Continent  Rock Record  Plate Motion  Tectonic Processes  Seafloor | 3.3.6.A1 3.3.7.A6 3.3.8.A6 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Some natural hazards such as volcanic eruptions and severe weather may be preceded by phenomena that allow for reliable prediction. Others such as earthquakes occur suddenly with no notice and are not yet predictable. | Investigate or develop a map of the history of natural hazards in a region to demonstrate an understanding of forecasting the likelihood of future events. | Natural Hazard  Earthquake |  | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating earth’s average surface temperatures and keeping it habitable. | Use models of earth’s atmosphere and surface to support the explanation of the greenhouse effect. | Atmosphere  Greenhouse Effect  Habitable |  | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Evolution is shaped by Earth’s varying geological conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. | Use arguments supported by evidence from the rock and fossil records to explain how past changes in earth’s conditions have caused major extinctions of some life forms and allowed others to flourish. | Fossil Record  Mass Extinction  Meteor Impact  Volcanic Eruption | 3.3.7.A3 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **7-8** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | As new life forms evolve, the life processes of those organisms may alter the physical and chemical characteristics of the ocean, atmosphere, and earth materials. | Use evidence from the rock and fossil records to investigate how evolution of new life forms has changed earth’s systems. | Fossil Record  Physical Characteristic  Chemical Characteristic | 3.3.7.A3 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
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| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials from the isotope ratios that are present. These data can be used to help determine the geologic time scale. | Analyze actual or simulated isotope ratios within earth materials to make valid and reliable scientific claims about the planet’s age, the ages of earth events and rocks, and the overall time scale of earth’s history.  Consider the incomplete nature of the earth’s rock record when analyzing and interpreting the events of Earth’s distant past. | Isotope  Earth Material  Geologic Time  Nuclear Lifetime  Radiometric Dating | 3.3.12.A1 3.3.10.A1 3.3.12.A3 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The radioactive decay of unstable isotopes continually generates new energy within Earth’s crust and mantle providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. | Use a model for earth’s interior including the mechanisms of thermal convection to support the explanation for the cycling of matter within the earth. | Isotopes  Plate Tectonics  Mantle  Crust  Thermal Convection  Cycling of Matter  Radioactive Decay | 3.3.12.A1 3.3.12.A3 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Continental rocks, which can be older than 4 billion years, are generally much older than rocks on the ocean floor, which are less than 200 million years old. | Construct explanations using the theory of plate tectonics for patterns in the general trends of the ages of both continental and oceanic crust. | Plate Tectonics  Oceanic Crust  Continental Crust  Continental Rocks | 3.3.12.A1 3.3.10.A1 3.3.12.A3 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from earth’s interior and gravitational movement of denser materials toward the interior. | Incorporate a variety of data including geological evidence from maps and representations of current plate motions to predict future plate motions.  Use models to explain how the flow of energy drives the cycling of matter between Earth's surface and deep interior. | Geological Evidence  Plate Motions  Mantle | 3.3.12.A1 3.3.10.A1 3.3.12.A3 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Our model of earth includes a hot but solid inner core, a liquid outer core, and a solid mantle and crust. | Integrate evidence from seismic waves, reconstructions of earth’s magnetic field, and an understanding of physical and chemical processes to explain the internal structure of the earth. | Seismic Wave  Magnetic Field  Physical Process  Core  Mantle  Crust  Inner Core  Chemical Process | 3.3.12.A1 3.3.10.A1 3.3.12.A3 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. | Explain how Earth's systems interact with each other. Describe an example of how two or more systems interact. |  | 3.3.12.A3 3.3.12.A1 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. | Analyze the physical and chemical properties of water to make valid scientific claims about the impact of water on the flow of energy and the cycling of matter within and among Earth systems. | Physical Properties  Chemical Properties  Earth systems | 3.3.12.A5 3.3.10.A5 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | The foundation for Earth’s global climate system is the electromagnetic radiation from the sun as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems and this energy’s re-radiation into space. | Use models of the flow of energy between the sun and Earth’s atmosphere, ocean and land to support explanations of how Earth’s radiative energy balance is affected by the absorption and retention of heat in Earth’s atmosphere. | Radiative Energy  Absorption  Retention  Re-Radiation  Electromagnetic Radiation  Climate System | 3.3.12.A6 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Geological evidence indicates that climate changes are either sudden caused by alternations in the atmosphere, longer term changes due to variations in solar output and orbital parameters or even more gradual atmospheric changes due to biological processes. | Read scientific literature critically to evaluate and communicate the causes and effects of climate change over 10-100s years, 10s-100000s years 10s-100000000s.  Utilize models to demonstrate the impact of Earth's orbit and axis of rotation impact climate. | Climate Change  Atmospheric Changes | 3.3.12.A6 |  |
| **9-12** | The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. | How do we describe and interpret Earth’s features, their origins, and the processes that shape them? | Global climate models incorporate scientists best knowledge of physical and chemical processes and the interaction of relevant systems. | Use geoscience data and the results from global climate models to make evidence based forecasts of climate change. | Climate Models  Climate Change  Physical Process  Chemical Process | 3.3.10.A3 |  |
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| **PreK-2** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. | Investigate what resources are used in the construction of buildings, preparation of food, transportation, and other aspects of the community. | Transportation  Community  Resources  Materials  Energy | 3.3.4.A2 | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
|  | | | | | | | |
| **3-4** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | Some resources are renewable on a human time scale, and others are not. | Investigate renewable and nonrenewable resources used in the construction of buildings, preparation of food, transportation, and other aspects of the community. | Transportation  Community  Resources  Materials  Energy |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.2.2  S4.A.3.1  S4.A.3.2  S4.A.3.3 |
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| **5-6** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | Humans depend on Earth’s land, ocean, atmosphere, and living things for many different resources. | Use maps and other data to explain how geologic processes have led to the uneven distribution of Earth's natural resources. | Map  Resources  Atmosphere  Land  Ocean  Geologic Processes | S8.D.1.1 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
| **5-6** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | Minerals, fresh water, and living resources are limited, and many are not renewable or replaceable over human lifetimes. | Use maps and other data to explain how geologic processes have led to the uneven distribution of Earth's natural resources. | Maps  Resources  Fresh Water  Geologic Processes | S8.D.1.1 | S8.A.1.1  S8.1.2  S8.A.1.3  S8.A.2.1  S8.A.2.2  S8.A.3.1  S8.A.3.2 |
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| **7-8** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | N/A | N/A | N/A | N/A | N/A |
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| **9-12** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | Resource availability has influenced the development of human society. | Evaluate the impact of the availability of renewable and nonrenewable resources on the development of civilization. | Renewable  Nonrenewable  Resources  Civilization  Society | 3.3.12.A3 |  |
| **9-12** | The Earth's processes affect and are affected by human activities. | How do Earth's processes and human activities affect each other? | All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical benefits, costs and risks. | Evaluate impact of using renewable and nonrenewable resources on the earth's system. | Renewable  Nonrenewable  Earth System  Economical  Geopolitical  Environment  Benefit  Cost  Risk | 3.3.12.A3 |  |